

SUBMISSION

OF

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to the

Australian Senate

SELECT COMMITTEE ON WIND TURBINES

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Summary

Recent evidence confirms and strengthens my 2010 conclusions that wind turbine noise at the levels permitted by Australian regulations has unacceptable adverse effects on sleep and health.

The NHMRC statement on wind turbine noise and human health fails in its duty to *“build a healthy Australia”* and to protect the public health by; reversing the burden of proof, applying an inappropriately high burden of proof and failing to properly apply the precautionary principle. They have, instead, applied the *“reactionary principle”* (Kriebel 2007), which is clearly not in the public interest. Had they correctly applied the precautionary principle, then, even using their present analysis, they would have called for an immediate moratorium on the construction of new wind turbines within at least 1.5km of residences and immediate reductions in noise emissions from existing wind turbines sited within 1.5km of residences. Had they applied a reasonable burden of proof, they would have called for a construction moratorium and noise emission reductions for turbines sited within 10km of residences. In addition, they would have mandated research by independent experts with relevant expertise in acoustics, sleep medicine and other relevant clinical disciplines, funded by the wind industry, as an urgent matter for the protection of public health.

The *“nocebo”* hypothesis is falsified at many levels. There is overwhelming evidence that the adverse health effects complained of by wind turbine neighbours and reported in the many publications cited in this and my 2010 submission are caused by the noise emissions of wind turbines.

The Australian regulations on wind turbine noise are not fit for purpose. They take no account of relevant earlier research, excessive amplitude modulation and low frequency sound emissions and were formulated to favour the industry rather than the public health.

Introduction

In November 2012, I was privileged to make a lengthy, detailed written submission to the Australian Senate Inquiry into Excessive Noise from Wind Farms and subsequently gave oral evidence on 13th November.

I concluded that: "... there is compelling evidence that wind turbine noise can and does disturb sleep and impair the health of those living too close and that current guidance is inadequate protection."

I see no useful purpose in restating my previous evidence as it is in the public domain and available to the Committee. I shall, therefore, restrict my evidence to three principal areas:

1. New evidence since 2012
2. Commentary on the recent NHMRC statement on wind turbine noise and human health
3. Commentary on the "nocebo" hypothesis

Fourthly, I shall comment on the wind industry and its supporters as "Producers of Doubt".

1. New evidence since 2012

1.1 Introduction.

In 2012, I cited a large body of evidence in support of my opinion that there was a significant risk to sleep and health for those living within 1.5km of industrial wind turbines. I note that the NHMRC statement on wind turbine noise and human health quotes a similar distance where they determine there are sufficient concerns to recommend research. I noted also that there was no original research which found that wind turbines were safe at that distance.

I describe below the new evidence published in the last 2½ years.

- 1.2 Morris (2012) presented a survey of the Waterloo Wind Farm in South Australia to the Parliamentary Select Committee on Wind Power. An anonymous, self reporting survey was sent to all 230 residences within 10km of the 3MW turbines. 93 (40%) were returned, a good response rate for this type of study. 40% reported night-time disturbance and 27 (29%) reported sleep disturbance (Figure 4)

This is not a strong epidemiological study in that it has not been peer-reviewed, has no control group and the survey instrument asked generalised questions to avoid leading respondents. Nevertheless, it had a good response rate and its findings are in accord with other similar studies. It represents strong supporting evidence. I note that it was considered acceptable by the NHMRC in its latest literature review, and that Professor Colin Hansen's acoustic field research at Waterloo (Hansen 2014) has confirmed excessive low frequency noise out to 8.7km, which provides independent acoustic data supporting Morris's findings.

- 1.3. Schneider (2012) conducted a similar study of the Cullerin Range Wind Farm in New South Wales, Australia. Responses were obtained from 73% of residences within 5km of the turbines of which 78.5% reported sleep disturbance from the development. (Figure 5). A follow-up study was conducted in 2013 (Schneider 2013) to answer allegations by Chapman (2013) in his "nocebo" studies that residents had not complained at Cullerin. A similar response rate was achieved with 91% of respondents living within 8km reporting an impact on their sleep. All had complained to a variety of authorities.

These are not a strong epidemiological studies in that they have not been peer reviewed, have no control group and the survey instruments asked generalised questions. Nevertheless, they had good response rates and the findings in both studies are in accord with each other and with other similar studies. It represents strong supporting evidence.

- 1.4. Mroczek and colleagues (2012) reported a survey of 1277 adults living near wind farms in Poland. 424 (33.2%) lived >1.5km, 221 (17.3%) 1-1.5km. 279 (21.9%) 700-1000m and 220 (17.2%) <700m from a turbine. The Polish version of the SF36 was administered with a Visual Analogue Scale for Health Assessment.

Taking all subjects together, they concluded that: *“Close proximity of wind farms does not result in the worsening of the quality of life”* and *“Within all scales, the quality of life was assessed highest by residents in areas located closest to wind farms, and the lowest by those living more than 1,500m from wind farms.”* These conclusions are at variance with all other studies reported here. The authors offered no mechanism for the apparent benefit of living close to a wind farm. In a personal communication (Mroczek 2013), the lead author stated that not all of the wind farms were operational at the time of the survey, some were under construction or in the planning stage. It would appear also that no allowance was made for any financial interest in the turbines which would be more likely for those living close to the turbines.

This analysis is therefore meaningless as it includes subjects not exposed to turbine noise at all and those living over 1.5km from the turbines. Taking into account also the failure to allow for any financial interest in the turbines, the conclusions can not be regarded as reliable.

- 1.5. McBride and colleagues (2014) administered the WHO Health Related Quality of Life test instrument to 25 persons living 700-3500m (average 1400m) from wind turbines. The study group had lower scores in all domains when compared to community and hospital inpatients and outpatient groups indicating a significant reduction in quality of life. They conclude: *“.., the fact that so many individuals scored so poorly must be a cause for concern.”*
- 1.6. Magari and colleagues (2014) administered a survey questionnaire to a small sample of residents living within a wind farm an average of 586m from the nearest

turbines. 26% reported sleep disturbance from the wind turbines. 8.9% had made noise complaints even though all residents were receiving a substantial property tax reduction and other financial benefits. The authors were clearly surprised at the level of sleep disturbance as they concluded: *“Additional research should include a detailed investigation of sleep patterns and possible disturbance in those living in and near operating wind turbine projects.”*

- 1.7 The Cape Bridgewater Wind Farm in Victoria, Australia has been subject to a recent, detailed, acoustic testing program in response to residents’ ongoing complaints of six years of sleep disturbance and other adverse health effects (Cooper, 2015). The study is unique in that it was undertaken by an independent group of acousticians and commissioned by the developer, Pacific Hydro, who co-operated fully in the study, including allowing full access to the wind turbines, and enabling background noise measurements to be taken when the turbines were off for other reasons, and publishing the report in full. Pacific Hydro are to be commended for their actions and stand in contrast to the attitude of other developers.

The survey was based on the six occupants of three houses sited between 650 and 1600 m from the nearest turbines. The full spectrum of acoustic frequencies and vibration inside and outside homes were measured for 8 weeks. Cooper analysed also the complaints of residents and noted that, in addition to sleep disturbance, they comprised “sensations”, which included headache, head, ear or chest pressure, tinnitus and heart racing. During the study period, residents were blinded to the acoustic measurements, and contemporaneously recorded detailed diaries of their individual perceptions of noise, vibration, and “sensations”. A dose response relationship is suggested by the trend line from the data relating to the occurrence of severe sensations (level 5) at the same time as elevated levels of infrasound, when compared with lesser severity sensations (level 2) and lower SPL’s of infrasound but Cooper concluded more data are required in order to properly establish correlation. These results are consistent with the Kelley research from thirty years earlier (Kelley 1985,7).

The residents also documented sleep disturbance when it occurred. No formal assessment of sleep was undertaken. The report states that: *“All of the residents indicated that over time their sensitivity to “noise” from the wind farm has increased and that there is regular occurrence of sleep disturbance to the point that their health has been affected (to varying degrees)”*. One home of the three studied has been abandoned. It should be noted that Thorne has previously studied this wind farm (Thorne 2012 and 2014) (see Section 1.8) and found poor sleep quality and adverse health effects in the residents.

The report concludes that: *“... with respect to sleep disturbance ... where ambient noise levels at night inside dwellings are typically below 15dB(A), then the concept of a 30dB(A) Leq threshold level identified in the New Zealand Standard ..., would appear to be an inappropriate threshold for the assessment of internal noise levels associated with wind farms.”*

- 1.8. Thorne (2012) in a submission to an Australian Senate inquiry into wind farm noise regulations has reported a survey of residents reporting health concerns living within 700 to 3500m of two wind farms, Cape Bridgewater and Waubra. The purpose of the study was to explore sound levels and character to inform future research. Similar health instruments were used to those in the Nissenbaum and Shepherd studies discussed in the 2010 submission. The general health effects were considered by McBride (2014) (Section 1.5)

Predicted sound levels at the residences ranged from 44-28dBLAeq. Measured sound levels at 5 residences ranged from 61-43dBLAeq and exceeded predicted levels by between 4-25dBA.

Twenty three of 25 (92%) participants reported Pittsburgh Sleep Quality Index scores >5 confirming that sleep disturbance is a major feature of health effects of wind turbine noise. The PSQI is a widely used and well validated measure of sleep quality. Scores >5 indicate poor quality sleep.

Thorne concluded: *“The measures of wind turbine noise exposure that the study has identified as being acoustical markers for excessive noise and known risk of serious harm to health (significant adverse health effects) are:*

- 1. An LAeq or ‘F’ sound level of 32 dB(A) or above over any 10 minute interval, outside;*
- 2. An LAeq or ‘F’ sound level of 22 dB(A) or above over any 10 minute interval inside a dwelling with windows open or closed.*
- 3. Measured sound levels shall not exhibit unreasonable or excessive modulation (‘fluctuation’).*
- 4. An audible sound level is modulating when measured by the A-weighted LAeq or ‘F’ time-weighting at 8 to 10 discrete samples/second and (a) the amplitude of peak to trough variation or (b) if the third octave or narrow band characteristics exhibit a peak to trough variation that exceeds the following criteria on a regularly varying basis: 2dB exceedance is negligible, 4dB exceedance is unreasonable and 6dB exceedance is excessive.*
- 5. A low frequency sound and infrasound is modulating when measured by the Z-weighted LZeq or ‘F’ time-weighting at 8 to 10 discrete samples/second and (a) the amplitude of peak to trough variation or (b) if the third octave or narrow band characteristics exhibit a peak to trough variation that exceeds the following criteria on a regularly varying basis: 2dB exceedance is negligible, 4dB exceedance is unreasonable and 6dB exceedance is excessive.*

Definitions: ‘LAeq’ means the A-weighted equivalent-continuous sound pressure level; ‘F’ time-weighting has the meaning under IEC 61672-1 and ref. 18; “regularly varying” is where the sound exceeds the criterion for 10% or more of the measurement time interval of 10 minutes; and Z-weighting has the meaning under AS IEC 61672.1 with a lower limit of 0.5Hz.

Approval authorities and regulators should set wind farm noise compliance levels at least 5 dB(A) below the sound levels in criterion (1) and criterion (2) above. The compliance levels then become the criteria for unreasonable noise.”

- 1.9 Paller and colleagues (Paller 2013) presented the results of a survey of nearly 5000 residences in Ontario counties containing 10 or more wind turbines at a conference organised by the Ontario government. Paller subsequently presented a fuller account as a Masters thesis. (Paller 2014). A highly statistically significant relationship was found between $\ln(\text{distance})$ from turbines and PSQI and vertigo. Modelled relationships had the same general form as those of Nissenbaum (2011)(See 2010 submission for details). They conclude that: “*future research should focus on the effects of wind turbine noise on sleep disturbance and symptoms of inner ear problems.*” Minimum setback distance in Ontario is 550m and over 80% of respondents lived more than 1km from the turbines. The strength of the relationship between distance and effect is strong evidence for a causal relationship.
- 1.10. The preliminary findings of a survey conducted under the auspices of Health Canada have just been made available (Health Canada 2014). A range of health and sleep measures were compared to measured and calculated wind turbine noise. The survey did not find a direct association between wind turbine noise and self-reported sleep, illness, stress and quality of life. A statistically significant relationship was found between annoyance and wind turbine noise exposure when calculated noise levels exceeded 35dBA. Wind turbine noise annoyance was statistically related to self reported sleep disturbance (PSQI), migraines, tinnitus, dizziness and objective measures of stress (hair cortisol, blood pressure and resting heart rate). It is reasonable to conclude from the data that adverse health effects occur at external turbine noise levels above 35dBA. ETSU-R-97 permits night time noise levels of 42dBA. Calculated outdoor A weighted wind turbine noise levels reached 46dBA. The authors compare the noise levels to those recommended by WHO from which it can be inferred that most subjects were exposed to lower levels. The WHO noise levels are based upon traffic noise. It is inappropriate to base wind turbine noise levels on traffic research for the reasons given in my previous evidence.

This study, and its interpretation, have been criticised (Krogh and McMurtry 2014) but its findings confirm that wind turbine noise has adverse health effects at noise levels permitted by Australian regulations.

1.11. There has been much misunderstanding over the term “annoyance” with some characterising it as trivial irritation. Annoyance in the context of studies of noise is a degree of disturbance sufficient to cause stress, which is a departure from health and well being. Whether sleep disturbance is mediated by a direct effect of noise or through annoyance, or a combination of both, it remains an adverse health effect. A recent study by van den Berg and colleagues (2014) examined the relationship between annoyance and self reported sleep disturbance from environmental noise and found them to be strongly associated, confirming that annoyance must be regarded as an adverse health effect.

1.12 **Conclusions**

It remains the case that there is no credible research showing that wind turbines have no effect on sleep and health at the set back distances permitted under Australian guidelines. The only study suggesting no effect (Mroczek, 2012) is fatally flawed, not least because many of the subjects were not subjected to turbine noise. The new evidence, detailed above, adds further weight to my original opinion that there is a significant risk to the sleep and health of those residing within 1.5km of industrial wind turbines and indeed extends the adverse effect distance to at least 5km based upon the most recent Australian studies.

2. NHMRC Statement on wind turbine noise and human health

2.1. Introduction

The National Health and Medical Research Council (NHMRC) describes itself as: “.. *Australia’s leading expert body promoting the development and maintenance of public and individual health standards.*” Its mission statement is “*Working to build*

a healthy Australia.” It is reasonable, therefore, to expect it to apply the fundamental principles of public health in its activities, including application of the precautionary principle (Martuzzi 2007).

The precautionary principle was characterized in the 1998 Wingspread consensus statement thus (Roffensperger 1999): “when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.” The statement goes on to list four central components of the precautionary principle:

1. taking preventive action in the face of uncertainty
2. shifting the burden of proof to the proponents of an activity
3. exploring a wide range of alternatives to possibly harmful actions; and
4. increasing public participation in decision-making.

Kriebel (2007) in commenting on Martuzzi’s editorial, commends the precautionary principle and notes that public health too often works on the reactionary principle whose key components are:

1. requiring incontrovertible evidence of harm for each hazard before taking preventive action
2. placing the burden on the public (or government agencies) to show that each chemical, material or technology is harmful
3. not considering potential health and environmental impacts when designing new materials and technologies, and
4. discouraging public participation in decision-making about control of hazards and introduction of new technologies.

- 2.2. NHMRC has undertaken a critical review of what it deems to be acceptable literature. Research published after May 2014 has not been considered. They find that: *“There is consistent but poor quality direct evidence that wind farm noise is*

associated with annoyance, as well as less consistent, poor quality direct evidence of an association between sleep disturbance and wind farm noise.” They considered evidence on noise emissions from other sources, road, rail and air and concluded that: *“it is unlikely that people would experience significant health effects beyond 1500 metres from wind farms.”* The corollary to that statement must be that people **are** likely to experience significant health effects within 1500 m. There is a large body of evidence to show that wind turbine noise can not be equated with road, rail and traffic noise. It is more annoying, less easily masked by background noise, has a greater low frequency noise content, propagates further and is greater at night. The final statement is thus not supported by the evidence.

- 2.3. NHMRC must have been aware of the many hundreds, if not thousands, of Australians living near wind farms who have complained of sleep disturbance and ill-health. They must also have been aware of the many abandoned homes. People do not abandon their homes because they are disgruntled, they do so for genuine fear for their health and they find their living conditions intolerable. The research review found evidence of adverse effects within 1.5km. Certainty is not necessary before taking action to prevent harm to the public health.
- 2.4 In considering the evidence, NHMRC adopted inappropriately strict evidential criteria. This is the reactionary approach to public health risks and is clearly not in the public interest. Action in defense of the public health does not require certainty. In addition, in my opinion, they have turned the burden of proof on its head. It is the wind industry’s duty to prove the safety of its activities not that of the public.
- 2.5. It is known that wind turbine noise emissions can disturb sleep and impair health, if this were not so, there would be no need for set back distances. The body which formulated the UK’s guidance, ETSU-R-97, which is the basis for the Australian standards, chose noise levels which they **“thought”** would afford the public **“reasonable”** protection. No certainty, just assumptions, only “reasonable” protection, with no definition of “reasonable”. No margin for error. In addition, the permitted noise levels were raised in order to facilitate the development of the wind industry. In the 17 years since ETSU was published, wind turbines have

increased in size from around 1MW with a hub height of 32m to 2.5-3MW, with a hub height up to four times greater, with a concomitant increase in noise, particularly low frequency noise. These facts, which demonstrate the capacity for harm, should have been known to the acoustician(s) advising the panel and should have provided the basis for an understanding of the potential for harm from wind turbine noise.

- 2.6. There are no large scale, randomized, double-blind, crossover trials of the effects of wind turbine noise on sleep and health. In the light of the evidence available to date, such trials on human subjects would probably be deemed unethical, assuming that volunteers could be recruited. What does exist is a large body of anecdotal reports, case control studies, observational reports and small controlled studies, **ALL** of which point in the same direction; wind turbine noise adversely affects sleep and health at distances permitted by Australian regulations. This is more than sufficient evidence for action.
- 2.7. What should NHMRC have done? Having reviewed the evidence, with the precautionary principle and its components in mind, they should have acknowledged that there was and is substance to the complaints. Even had they used their own analysis, they should have called for an immediate, nationwide moratorium on the construction of wind turbines within 1.5km of human habitation until high quality, independent research, funded by the wind industry, has demonstrated the safe setback distance appropriate for different sizes of turbine and topography. They should have called for immediate restriction of power output from existing wind turbines. However, had they applied appropriate and reasonable standards of proof rather than those that were inappropriately high, they would have called for a moratorium on construction and restrictions of power output for wind turbines within 10km of human habitation. They should have mandated that such restrictions not be lifted until high quality research by independent experts with relevant expertise in acoustics, sleep medicine and other relevant clinical disciplines, funded by the wind industry, had demonstrated safe external noise levels and power outputs.

3. The “Nocebo” Hypothesis

- 3.1. It is universally accepted that psychological factors influence an individual’s response to unwanted sound. Individuals vary in their sensitivity to noise just as with many other factors. About 15% of the population are “noise sensitive”. A dislike of turbines increases the response and financial gain decreases the response. However, these factors are only contributory and do not explain the entire response. Magari (2014) (Section 1.6) found high levels of sleep disturbance in a population with a considerable financial interest in the turbines. It is clear that physical factors are the main cause of adverse effects of wind turbine noise.
- 3.2 The “nocebo” hypothesis has been advanced suggesting that the symptoms reported by the thousands of subjects complaining of adverse effects from wind turbine noise are an example of a mass psychogenic illness (MPI) (Chapman 2013, Rubin 2014). Chapman claims that reports of adverse effects do not predate the earliest published papers, particularly the Pierpont case series (Pierpont 2009), and the ensuing publicity, and that the complaints are restricted to those wind farms where opposition groups were active in the planning stage.
- 3.3 This hypothesis is disproved by the Mroczek study cited above (Section 1.4). By combining data from active wind farms and those in the construction and planning stage, the authors were able to conclude that wind farms had no effect on quality of life measures and may even have been beneficial. However, Poland has a considerable number of groups opposing the installation of wind turbines, active since at least 2010. As a first world nation with good internet access, it is reasonable to suppose that the opposition groups would have been making the same objections as those in Australia, including the effects on sleep and health. It is reasonable to suppose also that opposition groups would have been active at many of the studied wind farms, especially those in the planning or construction phase. If the MPI hypothesis were correct, Mroczek should have recorded worsened quality of life measures at all wind farms whether active or in the construction or planning stages. She did not.

- 3.4. This hypothesis is further disproved by the observation that adverse reports predate the Pierpont book by over 20 years (Kelley 1985), many wind farms reporting adverse effects had no opposition groups, and the residents initially welcomed the turbines, including wind turbine hosts (Mortimer 2012). Stigwood and colleagues (2013), acousticians with considerable research experience of UK wind farms, note: *“This (the “nocebo” hypothesis) is contrary to our own direct evidence where many communities and individuals either did not object to the development, positively supported the development or moved near to the wind farm in the belief that it would not adversely affect them”*.
- 3.5. The hypothesis is further disproved by the evidence of several experienced acousticians who could reasonably be expected to be immune to such suggestions and have reported adverse effects (Ambrose et al. 2012, Stigwood 2013, Cooper 2015).
- 3.6. McMurtry (2013), Laurie (2013) and Hartman (2013) have analysed the Chapman papers in depth, detailing their bias and logical fallacies. Hartman concludes that the Chapman papers: *“fail to meet credible standards of professionalism to be taken seriously”*. The author concurs with this conclusion.
- 3.7. Chapman cites a laboratory based study in support of his hypothesis (Crichton 2013). Punch, an audiologist (Punch 2013), and Swinbanks, an acoustician (Swinbanks 2013), found the experiment itself, and its conclusions, to be seriously flawed, doubting that the volunteers were even exposed to infrasound. Government and industry accepts that adverse symptoms such as those described by Pierpont are due to turbine noise (Colby 2009). Adverse effects are found in children and animals who would not be susceptible to psychological factors.
- 3.8. In clinical medicine, a psychogenic explanation for reported symptoms is not entertained until possible physical explanations are excluded. To do otherwise would be construed as malpractice. There is a clear physical cause for the

symptoms reported by those exposed to wind turbine noise. Nissenbaum and Paller's studies (Nissenbaum 2012, Paller 2014) show a clear dose-response between distance and effects. Cooper's recent research at Cape Bridgewater, demonstrate a clear trend and dose response relationship of symptoms with concurrently measured levels of wind turbine infrasound inside homes. All of these are clear evidence of a causal relationship between wind turbine noise and effects on humans which would not be present for a psychogenic cause.

3.9 **Conclusions**

The "nocebo" hypothesis singularly fails to stand up to scrutiny as an explanation for the adverse effects of wind turbine noise on sleep and health.

4. Comments

- 4.1. Michaels (2005), an epidemiologist and former US assistant secretary of energy for environment and chief safety officer of a nuclear weapons complex, described the response of industries to the suggestion that their products or processes were causing harm to humans or the environment. He notes that laboratory and epidemiological studies of the effects of chemicals or drugs on humans have uncertainties and those charged with regulating the public health must extrapolate from the evidence to make causal inferences and recommend protective measures. Absolute proof is rarely present in science. Using examples from the tobacco, chemical and pharmaceutical industries he shows how companies manufacture doubt by producing their own research and seeking to discredit those studies which shows their product or process in a bad light. The latter studies are often characterized as "junk science" and the researchers denigrated.

Industry is assisted by compliant academics, consulting firms and government departments and agencies which can be counted upon to produce papers which undermine the original studies. They may do this by "reanalyzing" the original data and seeking to reduce the statistical significance of any findings, or conducting literature "reviews" which use the "reactionary principle" with inappropriate

burdens of proof to claim that there is “insufficient good evidence”. Alternatively, attempts may be made to suggest that the effects on humans or the environment may be due to some other cause, usually a factor that is either impossible to measure or very common, for example, social habits (tobacco, alcohol, living conditions).

Michaels notes also that such industries seek to influence those making regulatory decisions by seeking to exclude independently minded experts and substituting those who are favourably inclined. This process extends from the initial setting up of guidelines for safe limits through to revision of limits in the light of new research.

The industries’ aim is simply to muddy the waters, to create sufficient “doubt” so that they will be able to continue their activities unfettered by regulation.

- 4.2. Were Michaels to revise his paper for 2015, he would find the wind industry to be the perfect exemplar of this thesis. Acousticians regularly employed by the wind industry and compliant civil servants combined to ignore earlier research and produce noise level guidelines unique to the wind industry, permitting higher noise levels than were prudent in order to help the industry and higher still at night, contrary to evidence and common sense.

When the inevitable complaints began to emerge, complainants were ignored or brushed off. Dr Nina Pierpont in the US published a book (2009) detailing a case series of people adversely affected by wind turbine noise, creating the term “wind turbine syndrome”. For her pains, she has been vilified in the media with attempts to discredit the research and denigrate her professionalism. Dr Sarah Laurie, of the Waubra Foundation in Australia, has suffered similar attacks on her professionalism and attempts made to hamper her ability to act as a major source of information to the public.

Dr Steven Cooper has been subjected to similar attacks following publication of his Cape Bridgewater studies. Schomer and Hessler, two highly respected US acousticians, the former Standards Director for the Acoustical Society of America, have written two open letters (2015 a and b) endorsing Cooper’s work. They note

that it is exactly what it claims to be, a simple, but very detailed, observational study of a small number of affected individuals which, nevertheless, provides a high degree of proof of a causal relationship between wind turbine emissions and symptoms. They further predicted the nature of the attacks, “reanalysis” and criticism of their qualifications, which proved to be well founded. Interestingly, the second letter is entitled: *“Muddying the waters”*.

In giving expert evidence (for a list, see section 6) I have been subject to personal attack. When I last gave evidence to the Australian Senate, one Senator asked my views on climate change, clearly hoping to smear me as “denier” and thus imply that my opinions were not to be trusted. In Ontario, consulting epidemiologists, often employed by the wind industry, have “reanalysed” our data in an attempt to reduce its significance and have produced “reviews” of the literature attempting to demonstrate that there is “insufficient” evidence for our assertions. Government agencies have joined in (See Section 2), misapplying the usual processes of protecting the public health.

Finally, distraction “evidence” is advanced, in this case, the “nocebo” hypothesis (Section 3).

- 4.3. The purpose or effect of these activities is to sow the seeds of doubt and undermine the evidence of harm. To give regulators and decision makers “reasons” for permitting developments and not taking action when complaints are made. In my opinion, it is time this obfuscation was recognised for what it is and the public properly protected from the adverse effects of wind turbine noise on their sleep and health.

5. Conclusions

My evidence and conclusions are fundamentally unchanged from those given in 2012 save that the safe setback distance for larger turbines must be at least 5km and may be as much as 10km in some circumstances. I have absolutely no doubt that wind turbine noise has adverse effects on sleep and health at the distances

permitted by Australian regulations. They are not fit for purpose. The additional evidence that has accrued in the intervening years has served to strengthen my certainty in the validity of that opinion.

Dr Christopher Douglas Hanning

24th February 2015

6. About the author:

Dr Christopher Hanning, Honorary Consultant in Sleep Disorders Medicine to the University Hospitals of Leicester NHS Trust, based at Leicester General Hospital, having retired in September 2007 as Consultant in Sleep Disorders Medicine. In 1969, he obtained a First class Honours BSc in Physiology and, in 1972, qualified in medicine, MB, BS, MRCS, LRCP from St Bartholomew's Hospital Medical School. After initial training in anaesthesia, he became a Fellow of the Royal College of Anaesthetists by examination in 1976 and was awarded a doctorate from the University of Leicester in 1996. He was appointed Senior Lecturer in Anaesthesia and Honorary Consultant Anaesthetist to Leicester General Hospital in 1981. In 1996, he was appointed Consultant Anaesthetist with a special interest in Sleep Medicine to Leicester General Hospital and Honorary Senior Lecturer to the University of Leicester.

His interest in sleep and its disorders began over 30 years ago and has grown ever since. He founded and ran the Leicester Sleep Disorders Service, one of the longest standing and largest services in the country, until retirement. The University Hospitals of Leicester NHS Trust named the Sleep Laboratory after him as a mark of its esteem. He was a founder member and President of the British Sleep Society and its honorary secretary for four years and has written and lectured extensively on sleep and its disorders and the effects of wind turbine noise (e.g. Hanning and Evans 2012) and continues to be involved in research. His expertise in this field has been accepted by the civil, criminal and family courts. He has been accepted as an expert on sleep disturbance related to wind turbine noise by the Ontario High Court and Environmental Review Tribunal and at planning inquiries in the UK, Canada and Ireland. He has given evidence on wind turbine noise and its effects to the Irish Parliament and Australian Senate. He chaired the Advisory panel of the SOMNIA study and sat on the Advisory panel for the Medicated Sleep and Wakefulness study, both major projects investigating sleep quality in the elderly, and sat on Advisory panels for several companies with interests in sleep medicine.

He was an Associate Member of the General Medical Council, chairing Investigation Committee hearings, until 2014. In 2010, he was invited to join the Board of the Society for Wind Vigilance.

He lives in Ashby Magna, Leicestershire, UK which is within 1km of the Low Spinney Wind Farm.

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